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Does Financial Innovation Affect the Demand for Money in Nigeria?

Gbadebo, Olusegun Odularu

Department of Economics and Development Studies,
College of Business and Social Sciences (CBS) Covenant University, P.M.B. 1023,
Km 10 Idiroko Road, Ota, Ogun State, Nigeria

Abstract: The demand for money is a very crucial in the conduct and determination of the effectiveness of monetary policy. This study attempts to analyse whether financial innovations that occurred in Nigeria after the Structural Adjustment Programme of 1986 has affected the demand for money in Nigeria using the Engle and Granger Two-Step Co integration technique. Though the study revealed that demand for money conforms to the theory that income is positively related to the demand for cash balances and interest rate has an inverse relationship with the demand for real cash balances, it was also discovered that the financial innovations introduced into the financial system have not significantly affected the demand for money in Nigeria. Based on the results obtained, *a* policy of attracting more participants (non-government) and private sector funds to the money market is necessary as this will deepen the market and make the market more dynamic and amenable to monetary policy.

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INTRODUCTION

The concept of financial innovation is not an entirely new phenomenon in economics but its pace over the last two decades of the twentieth century has thrown up new challenges to perhaps one of economics most hotly debated topics: the demand for money. The empirical study of the demand for money is one of the most popular subjects in applied econometrics [1]. The search for a stable demand for money has been a very contentious issue since the great intellectual debates between Keynesians and Monetarists of the 1960s and 1970s, as no demand for money model set forth by any of these two schools as well as their contemporaries has withstood the test of time. The instability of the demand for money in the 1970s and in the 1980s has been attributed primarily to changes in the performance of financial markets in the area of new financial products arising out of financial innovations.

Financial innovation is becoming increasingly important in the 21st century as it poses a serious problem for monetary policy, as with new financial products the ability of monetary policy to be effective diminishes, as it changes one variable vital for effective monetary policy; the demand for money. Financial innovation refers both to technological advances which facilitate access to information, trading and means of payment and to the emergence of new financial instruments and services, new forms of organization and more developed and complete financial markets [2]. With new financial products, contractionary monetary policy for instance, targeted at reducing excess liquidity as economic agents can easily move money from less liquid holdings to more liquid packages being offered by financial intermediaries. In the process, undermining monetary policy, the reverse occurs vice-versa. In effect financial Innovation has also raised serious problems in the definition and measurement of money. This study seeks to replicate empirical works carried out in the Western world in Nigeria to see if financial innovation has had significant effects in altering the demand for money in Nigeria.

There is and has always been, considerable disagreement among economists over what determines the levels and rates of growth of output, prices and

Corresponding Author: Gbadebo, Olusegun Odularu, Department of Economics and Development Studies, College of Business and Social Sciences (CBS) Covenant University, P.M.B. 1023, Km 10 Idiroko Road, Ota, Ogun State, Nigeria. Tel: 2348034736572; 234-01 - 8179667, Ext. 2121; Fax: 234-01- 8179668, E-mail: gbcovenant@yahoo.com, gbadebo.odularu@wto.org.

employment. The appropriate tool for macro-economic stabilization depends on the underlying theory in use. Keynesians would go for fiscal policy while monetarists would clamour for monetary policy. Monetary policy refers to the use of interest rates, money supply and credit availability to achieve macro-economic objectives. The use of monetary policy as a tool for macro-economic stabilization depends largely on the behaviour of the demand for money or real cash balances in the hands of economic agents. This brings in the demand for money function which expresses a mathematical relationship between the quantity of money demanded and its various determinants; interest rate, income, price level, credit availability, frequency of payments etc. The stability of these relationships (elasticities) is vital for in determining the appropriateness and effectiveness of the tools or instruments of monetary policy.

The year 1973 is a watershed in the history of the various models and specifications put forth as regards the demand for money as Stephen Goldfeld published his analysis of post-World War II quarterly data on the demand for money using M1 definition of money (i.e. currency in circulation + demand deposits) and found that the real income elasticity of demand for real M1 balance was positive but less than one. The interest rate elasticity of demand is negative and the demand for nominal cash balances is proportional to the price level. Hence the demand for money is the demand for real balances and no money illusion exists [3].

However, in recent times the instability of the previously stable money demand for money function has thrown up new studies at its various determinants and several other fronts have been explored by economists and econometricians alike. One of theses fronts is financial innovation which has blurred the distinction between M1 and other assets. It has blurred the various definitions of money – M1, M2, M3 etc *(ibid*).

In Nigeria, it has begun to hit home with the recent recapitalization of the banking sector, with the banks now bringing in new financial products that have combinations of savings features, higher interest earnings, easy withdrawals and transfers, with increasingly close substitutes for money being introduced by the day, good news for customers but a hellish nightmare for monetary authorities.

The main problem with the stability of the demand for money began with one man's work in 1973, American professor; Stephen Goldfeld. Prior to [4], the evidence that had accumulated from the large body of research done over the post – world war period was interpreted as showing that a stable demand function for money did, in fact, exist. In 1973, Stephen M. Goldfeld computed a demand for money function using quarterly postwar data up to 1973. Although Goldfeld's results differed in several important ways from those of the earlier literature, which were based mainly on annual data, his preferred specification became the standard formulation. Goldfeld's findings held that the quarterly demand function for money was most stable when:

- A narrow transactions definition of money was used.
- A short-term market rate of interest like the Treasury bill or commercial paper rate was used and when the rate on savings deposits was included.
- Measured income (real GNP) was used rather than permanent income or wealth.
- Lagged money was included to allow for incomplete adjustment in the short run.

But starting in 1974, forecasts from Goldfeld's equation began to seriously over predict real money balances. When the equation was re-estimated with data including post-1973 data, The coefficient on the lagged dependent variable became very large (implying implausibly long adjustment lags) and sometimes it was having values greater than unity (implying money demand is dynamically unstable). Soon, the demand for money function had become "unstable" in the sense that it had become more difficult to predict without serious accuracy errors.

This problem of estimating a stable money demand function as stated earlier has thrown up several lines of research. A line of inquiry sought to look at the pre-1973 agenda of empirical issues that focused on interest rate and inflation. Another line of investigations have suggested that the trouble is linked to changes in the financial market [5-7]. It is argued that financial innovations have led to deterioration in the marginal relationship between real money balances and interest rates. Economic literature stating that financial innovations affect the link between interest rates and money demand are not entirely new [8]. Infact, this is the building block of the theories of Gurley and Shaw [9] They posited that the definition of money should include all other assets which can serve as close substitutes for money, then by attaching respective weights to this assets depending on the level of their substitutability, Gurley and Shaw hypothesized a wide proliferation of money substitutes which increased the interest elasticity of money demand.

The paper has five sections, each dealing with the different aspects of the study. Section two presents a review of relevant literature, while section three discusses the theoretical framework and model specification of the study. Section four focuses on model estimation and analysis of the regression result and fifth section concludes the paper with relevant policy recommendations.

Objectives: The broad objective of this study is to examine the role of financial innovation on money demand in Nigeria. The specific objectives of this study include:

- To examine the degree of the relationship between financial innovation and the money demand in the Nigerian economy.
- To see how this relationship affects the effectiveness of monetary policies in Nigeria.
- To make policy recommendations based on the findings of the study.

Justification: This study is of utmost importance as it looks at several reasons accounting for the instability of the demand for money which is very vital in determining the effectiveness of monetary policy. These are as follows;

- It is important to know if money demand function is unstable as a result of financial innovation. Knowing this is vital to the relationship between interest rates and aggregate expenditure as this is important for choosing instruments for conducting monetary policy. If the demand for money is significantly affected, then the case for conducting macro-economic stabilization by regulating the growth of the money supply and interest rate changes may be seriously threatened. As such this research project will be of importance to monetary policy makers (Central Bank of Nigeria).

Research Hypothesis: In testing the relationship between financial innovation and the demand for money two hypotheses will be drawn is as follows:

- The relationship between financial innovation and the demand for money;

H_0 : Financial innovation has no impact on the demand for money.

H_1 : Financial innovation has an impact on the demand for money.

- The relationship between SAP era financial sector liberalization and the demand for money;

H_0 : SAP era financial sector liberalization policies have had no impact on the Demand for money.

H_1 : SAP era financial sector liberalization policies have had an impact on the Demand for money.

Review of Relevant Literature: Over the last two decades, an enormous body of literature has documented the continuing instability of standard econometric money demand specifications and attributed the instability to innovation in the private financial sector, Ireland [10]. The question of whether the demand for money function is stable is one of the most important recurring issues in the theory and application of macroeconomic policy. What is being sought in a stable demand function is a set of necessary conditions for money to exert a predictable influence on the economy so that the central bank's control of the money supply can be a useful instrument of economic i.e monetary policy.

The conventional money demand equation has been one of the most widely studied relationships in macroeconomics. First, there is the question of the constraint that is imposed on money balances, whether the appropriate constraint is a measure of wealth or income, or some combination of the two. The second issue in most literature has centered on the importance of interest rates and price changes as arguments (independent variables) in the demand function. The third issue is the question of the definition of money balances. Is a more stable demand function obtained if money is defined inclusive or exclusive of time and/or savings deposits and perhaps other assets that have value fixed in money terms? i.e either M1 or M2.

A rich tradition exists on the estimation of money demand in the United States than in any other country. Going by economic literature, the differences in the specification of the variables in the money demand function have produced important differences in implications or results. Tobin [11] and Baumol [12] separately considered the transactionary demand for money as a problem in capital theory and each obtained a demand function for cash balances which depends on costs and yields. Both Baumol and Tobin deduced from their models that there are economies of scale in holding transaction balances. An income or wealth elasticity less than unity would confirm this implication. Friedman's empirical findings however suggest that money is a "luxury" and that the relevant elasticity is in the

neighborhood of 1.8. [13]. However going by empirical literature, most Economists seem to accept Friedman's empirical result in preference to those of Baumol [12] and Tobin [12], though there seems to be some debate over the specification of the variables in Friedman's money demand function. Specifically, Friedman's use of per capita permanent income combines wealth, interest rates, population and lagged income into a single variable which combines and masquerades their separate effects.

Tobin [14] accorded the rates of return on financial and non-financial assets an important role in his theory of asset choice. Friedman's essay on the quantity theory stresses a view of the quantity theory as a theory of the demand for money. He uses bond and equity yields as direct arguments in the demand function. But his empirical findings suggest the importance of per capita permanent income and exclude interest rates as direct arguments of the function or assign them a role of second order of importance. Bronfenbrenner and Mayer [15] estimated the separate effects of wealth and interest rates along with income and lagged money balances. Their results show that interest rate, income and lagged money balances are statistically significant by the usual tests, but the wealth variable is non-significant.

Another issue quite common in literature is the definition of money is itself which still remains an open question. Gurley and Shaw [9] suggested that monetary theory should be concerned with a concept broader than the liabilities of commercial banks. Friedman's empirical work is based on a concept of money that includes the time deposit liabilities of commercial banks while Latane [16], Bronfenbrenner and Mayer [15] and others have been chiefly concerned with money defined as the sum of demand deposits and currency.

In terms of econometric work, Courchene and Shapiro [17] identified certain dynamic problems with early literature on the demand for money; difficulties with autocorrelation arising from the presence of the lagged money stock which possessed a significant role. Thus, the distinction between the long-run and short-run demands for money surfaced. Chow [18] argued that short-run money demand adjusted slowly toward long-run equilibrium; this stock-adjustment specification has weathered significant storms and remains the centerpiece of many money demand studies. The stock-adjustment specification did not go unchallenged, however.

Feige [19] demonstrated that a model of the long-run demand for money produces equations similar to those emanating from the stock-adjustment model without requiring slow adjustment of money demand when the determinants of demand are permanent, rather than current, values. No distinction exists between long-run and short-run demands for money. The long-run money demand depends on permanent (long-run) values of the determinants of money demand. To the extent that permanent variables can be modeled with distributed lags of measured values, the inclusion of measured, rather than permanent, variables into money demand mimics the stock-adjustment specification. Second, the stock-adjustment model implies unusual dynamic adjustment when the money stock is exogenous. The determinants of money demand must overshoot their long-run (permanent) values to clear the money market on a period-by-period basis and [20].

In 1973, Stephen M. Goldfeld examined the issues systematically, using quarterly postwar data up to 1973. Although Goldfeld's results differed in several important ways from those of the earlier literature, which were based mainly on annual data, his preferred specification became the standard formulation. The form of the Goldfeld equation is shown in below. The empirical estimates of the equation;

$$\ln (M1_t/P_t) = \beta_0 + \beta_1 \ln GNP_t + \beta_2 \ln RMS_t + \beta_3 \ln RSAV_t + \beta_t \ln(M1_{t-1}/P_{t-1})$$

Where
M1 = currency plus checkable deposits;
P = the aggregate price level;
GNP= real gross national product;
RMS = a short-term market rate of interest;
RSAV= rate of interest on savings deposits.

In summary, Goldfeld discovered that the quarterly demand function for money was most stable when:

- A narrow transactions definition of money was used;
- A short-term market rate of interest like the Treasury bill or commercial paper rate was used and when the rate on savings deposits was included;
- Measured income (real GNP) was used rather than permanent income or wealth and.
- Lagged money was included to allow for incomplete adjustment in the short run.

Theoretical Framework and Model Specification: The conventional textbook formulation of the demand for money typically relates the demand for real money balances (m = M/P), to the interest rate, r and some measure of economic activity such as real GNP (y = Y/P),

where M = money holdings, P = the price level and Y = gross national product. Thus,

$$m = f(r, y)$$

Several theories have been put forward to explain the equation above. Perhaps the most satisfying are those of the transactions view, in which the demand for money evolves from a lack of synchronization between receipts and payments and the existence of a transactions cost in exchanging money for interest-bearing assets (usually taken to be short term). Of relevance to this research project's model will be a select few. This will serve as a base for the model to be specified.

Keynes formulated his theory of demand in his well known book, the General Theory of Employment, Interest and Money in 1936. According to him, the demand for money arises out of its liquidity; liquidity refers to the convertibility of an asset into cash. He then identified three motives for holding money;

- Transaction Motive: this arises out of money's medium of exchange role and arises out of the need for bridging the gap between periodic receipts and payments. Keynes recognized both the income motive for households and business motives for firms. Given the society's basic institutional and technical customs and practices which govern income receipt and the flow of expenditures, the transactions demand depends on personal income and business turnover. It thus varies in direct proportion to changes in money income. Symbolically it is written as:

$$L_t = k_t(Y)$$

Where;

L_t : Transactions demand for money
k_t : The fraction of money income society desires to hold as transaction balances.
Y : money income

- Precautionary Motive: this arises out of unforeseen circumstances or expectations regarding the uncertain future by economic agents. Keynes posited that households sometimes keep money for unexpected contingencies such as medical emergencies or events while firms held balances above transactionary balances based on expectations about the economy e.g. a boom or depression. Keynes held that the level of precautionary balances varied with income and not interest rate changes. Symbolically;

$$L_p = k_p(Y)$$

Where;

L_t : Precautionary demand for money
k_p : The fraction of money income society desires to hold as precautionary balances.

Keynes usually lumped both motives together as they were both affected by the same institutional factors which he assumed given and fairly stable in the short run adding to the fact that they were both interest inelastic. Mathematically,

$$L_1 = L_t + L_p = k_t(Y) + k_p(Y) = k(Y)$$

Where;

L_1 : Demand for active balances

- Speculative Motive: this falls under the idle balances held by economic agents according to Keynes. He posited that people hold or hoard money above their active balances for the purpose of being able to earn some form of gains by speculating on bond prices. Since individuals knew that an inverse relationship exists between bond prices and interest rate, they held money for the opportunity to partake in such speculative activities so as to earn some form of interest.

According to Keynes, there thus existed an inverse relationship between speculative demand for money and interest rates. Functionally, this is expressed as;

$$L_2 = f(i)$$

Where;

L_2 : Speculative demand for money
i : Interest rate

Keynes concluded by positing that the total demand for money consists of demand for active balances (L_1) and that of idle balances (L_2). Thus,

$$L = L_1 + L_2$$
$$L = k(Y) + f(i)$$

However, Keynes demand for money theory has been criticized for unnecessarily bifurcating aggregate demand for money into transactions and speculative demand.

The transactions demand for money depended on income level (but Keynes had assumed a constant relation between money holdings and income.) his speculative demand was based on portfolio approach which considered the yields of assets vis-à-vis their competition with money held in individuals' portfolio. Again, he further limited his analysis to two assets; money and bonds. The combination of demand motives with two different approaches is inconsistent [21].

Furthermore on the theory of the demand for money, Baumol-Tobin Portfolio Formulation of the Demand for Money is perhaps most widely taught demand for money theory which seeks to explain the demand for money as a function of income and interest rates. It arose as a defence by Keynesians to the inconsistencies of Keynes liquidity theory. Its simplest version is the so-called square root of money holdings and it was put forward by two economists. Tobin (February 1958), looked at the demand for money from the risk angle in his "Liquidity Preference as Behavior towards Risk" paper while Baumol (1952) in his "Transactions Demand For Cash: An inventory Theoretic Approach".
His equation is;

$$M = \left[kY \big/ 2r \right]^{1/2}$$

This implies that nominal money holdings for cost minimising individuals varies directly with the square root of planned nominal expenditures and inversely with the square root of market interest rate. It could also be expressed in real terms by deflating each nominal variable above with the price index.

Most empirical validations of the above theory use the narrow money stock (currency plus demand deposits, M1) as the dependent variable often deflated by the implicit GNP deflator. Income is defined as real GNP or GDP and the interest rate is usually measured in two ways; by the rate on commercial paper and by the rate on time deposits.

Several authors' regression specifications base their regressions using this style. E.g. (Hafer & Hein, 1984) (Judd and Scadding, 1982) etc.

Their explicit specification usually is:

$$M_t = \$_0 + \$_1 y_t + \$_2 r^c + \$_4 y^d{}_t + U_t$$

Where;

Y : Income

r^c : Rate of commercial paper (variable used as a measure of financial innovation.)

R^d : Rate on time deposits.

M : Monetary aggregate.

t : time

Usually the growth rate of Money supply is used; alternative specifications use a lagged value of Money supply as one of the regressors which necessitates the use of auto-correlation corrective techniques.

$$\text{In } M_t = \$_0 + \$_1 \text{ In } y_t + \$_2 \text{ In } r^c{}_t + \$_4 \text{ In } r^d{}_t$$

The resulting inference from their theory is that the demand for money is positively related to income and inversely related to interest rate.

Model Specification: To successfully examine the impact of financial innovation on the demand for money in Nigeria, the following model will be used for our empirical test.

$$M = f(Y, RTD, RTB, DSAP, CPI, M_{t-1}\, u) \qquad \text{(i)}$$

Where;

M : a monetary aggregate (in the case of this study M2).

Y : Income as captured by Gross Domestic Product RGDP which seems to be most appropriate proxy variable for capturing the level of transaction.

RTD : Nominal Rate of interest on time deposits kept in commercial banks. Interest rate measures the opportunity cost of holding money that is, the reward for parting with liquidity. It reflects the degree of substitutability between money and bonds or other forms of financial assets. This is appropriate for our use of M2.

RTB : Nominal Rate on Treasury Bills. (A Proxy variable for the 4-6 Month Commercial paper rate.)

DSAP : dummy variable to capture the financial innovations that have taken place since the sweeping reforms of the Structural Adjustment Programme (SAP) embarked upon by Nigeria in 1986 which led to changes in the financial system.

CPI : Consumer Price level

M_{t-1} : one period lag of M

t : Time period

u : Stochastic random term.

In a more explicit and econometric form;

$$M_t = \beta_0 + \beta_1 Y_t + \beta_2 RTD_t + \beta_3 RTB_t + \beta_4 DSAP + \beta_5 CPI + \beta_6 lM_t + U_t \quad \text{(ii)}$$

Representing the above equation in a log-linear form;

$$\log M_t = \beta_0 + \beta_1 \log Y_t + \beta_2 \log RTD_t + \beta_3 \log RTB_t + \beta_4 DSAP + \beta_5 \log CPI + \beta_6 \log M_{t-1} + U_t \quad \text{(iii)}$$

A model of demand for money should establish a stable relationship between demand for money and the factors influencing it. Theoretically, the demand for money is hypothesized to be an increasing function of some measure of income or wealth. The coefficient of real income ($\$_1$) should be positive since real income demanded rises with the level or value of transactions. The coefficients $\$_2$ and $\$_3$ of the two rates RTB and RTD respectively are expected to be negative. This is because of the inverse relationship that exists between interest rates and real cash balances.

The estimation technique to be used in the above model is the co integration technique which is an improvement on the classical Ordinary Least Squares technique. One reason for the choice of this technique is that, first, it is generally argued that most economic series are non-stationary i.e. have a strong trend over time. By non-stationary, we mean that the variables do not have a mean which is constant over time and as such direct application of least squares technique could give spurious results. This causes the results of most OLS regressions to be statistically invalid and difficult to interpret in a theoretical context [1].

Co integration, error-correction modeling involves four steps. Though in a thin line separates steps two and three which necessitates their merging. First, determine the orders of integration for each of the variables under consideration; that is, difference each series successively until stationary series emerge. Second, estimate co integration regressions with ordinary least squares, using variables with the same order of integration. Third, test for stationary residuals of the co integration regressions. Finally, construct the error-correction models [22].

These steps are further explained as follows;

Determining the Order of Integration: The most popular approach is to use what are called augmented Dickey-Fuller, or ADF, tests. Basically what this step seeks to do is establish whether a particular time series is stationary or non-stationary. If non-stationary then is has to be differenced either once or twice.

To carry out this test, we test the null hypothesis of a difference stationary against the alternative hypothesis of a trend stationary. That is:

$$H_0: Y_t \sim I \quad (1)$$
$$H_1: Y_t \sim I \quad (0)$$

The test statistics of the estimated coefficient of y_t is then used to test the null hypothesis that the series is non stationary. If the absolute value of the test statistics is higher than the absolute value of the critical T value (which could be at 1, 5 or 10 percent), then the series is said to be stationary, therefore, we reject the null hypothesis. If the null hypothesis cannot be rejected then y_t cannot be stationary i.e. y_t is non stationary. It may be of order one i.e. I(1) or order two i.e. (2) or have an even higher order of integration. This will be revealed by differencing y_t till it becomes stationary.

Co integration Regression: The second stage proceeds to obtain the co integration (error correction) vector in the regression equation using OLS.

Test for Stationary Residuals of the Co Integration Regressions: Here, we test if the residuals (u_t) are stationary. This involves examining the estimated residuals from the regression directly by performing a unit root test of the ADF type. Once it is discovered that the residuals here are stationary, then it is possible that our variables are co integrated in the long run.

Construct the Error-correction Models (ECM): The final stage in the model building process requires the construction of error construction models. This involves regressing the first difference of each variable in the co integration equation onto lagged values of the first-differences of all of the variables plus the lagged value of the error-correction terms (that is, the error term from the co integration regression). [22] The ECM incorporates the full (short-run) dynamics of the stated model. At this stage, all the conventional statistical tests of significance are considered to be appropriate.

The purpose of the ECM is to switch to a short run model. The ECM indicates the speed of adjustment from short run equilibrium to the long run equilibrium state. The greater the co-efficient of the parameter, the higher the speed of adjustment of the model from the short run to the long run.

Table 4.1: Unit Root Test at Levels

Variable	Adf (Untrended)	Adf (Trended)
LOGM2	- 0.830393	-2.504330
LOGRTD	-1.378753	-0.424075
LOGRTB	-1.116305	-1.615467
LOGCPI	0.667872	-1.843997
LOGRGDP	0.138303	-1.594776

Note: ADF represents Augmented Dickey Fuller.

Table 4.2: Unit Root Test at First Difference

Variable	Adf (Untrended)	Adf (Trended)
DLOGM2	-3.200968*	-3.493219**
DLOGRTD	-3.373649*	-4.143771*
DLOGRTB	-5.233463*	-5.168919*
DLOGCPI	-3.184444*	-3.143145
DLOGRGDP	-3.678475*	-3.646344*

Note: * Stationary at 5 percent

**Stationary at 10 percent

Table 4.3: Unit Root Test of Residuals

Variable	Adf Trended	Adf Untrended
RESID	-4.971036	-4.845470

Table 4.4: Short run Error Correction Model

Variable	Coefficient	Std. Error	T. Stat
C	0.118694	0.047476	2.500101
DLOGCPI	0.301801	0.080615	3.743719
DLOGRGDP(-3)	1.424761	0.316660	4.499345
DLOGRTD	0.114115	0.0773840	1.474653
DLOGRTD(-3)	-0.190934	0.086969	-2.195435
DLOGRTB	-0.044140	0.075042	-0.588204
DLOGM2(-1)	0.459597	0.187357	2.453051
DLOGM2(-3)	-0.280104	0.113231	-2.473728
DSAP	-0.034131	0.031105	-1.097300
EC(-1)	-0.601865	0.252520	-2.383429

R-SQUARED: 0.797900
ADJUSTED R-SQUARED: 0.711285
D-W STATISTIC: 2.190635
F-STATISTIC: 9.212085

Data Analysis and Interpretation: This section presents the results obtained in the study. Table 4.1 shows the unit root test of the variables at levels while table 4.2 shows the unit root test of the variables at the first difference. Table 4.3 shows the unit root test of the residual obtained from the ordinary least square regression while table 4.4 shows the error correction model.

RESULTS AND DISCUSSION

Here, a series stationarity tests was carried out on all variables. This test is paramount due to the non-stationarity feature of most annual time series data. This was carried out using the Augmented Dickey Fuller (ADF) test statistics. Table 4.1 above showed that all the variables were not stationary in levels. This can be seen by comparing the observed values (in absolute terms) of the ADF test statistics with the critical value (also in absolute terms) of the test statistics at the 5% and 10% level of significance test. Therefore, the null hypothesis is accepted and it is sufficient to conclude that there is the presence of unit root in the variables at the 5% and 10% levels of significance.

Following from the results obtained above, all the variables were differenced once the ADF test was conducted on them. Table 4.2 shows the results obtained. A close look at the table reveals that all variables are stationary at the 5% level of significance except M2, which was significant at the 10% level of significance. Also, CPI was not stationary when a trend was applied to it in its first difference form. Thus, on the basis of the results in table 4.2, the null hypothesis is rejected and it is safe to conclude that the variables are stationary. This implies that the variables are I (1) series, i.e. integrated of order 1.

Co-integration Test: Here, two steps take place here, firstly, an ordinary least squares regression was carried out using the variables in our model specified with the exclusion of DSAP. This thus converts the form of our model to:

$$L\log M_t = \beta_0 + \beta_1 \log {Y_t}/{P_t} + \beta_2 \log RTD_t + \beta_3 \log RTB_t + \beta_5 \log CPI + \beta_6 \log M_{t-1} + U_t$$

Our results are thus presented in the appendix.

The residuals from the above regression are then saved and tested for stationarity (using the ADF method) to prove if the variables are co integrated in the long run before an error correction model can be put forward. Given that the residuals from the co-integrating regression are stationary, then it is possible for co integration to take place among our variables. The result of the unit root test of the residuals is presented in table 4.3 below;

From the table above, the residual was stationary at 5% level of significance As a result of this; one can rightly say that there is a long run relationship between all the variables used in the demand for money function. Given this result, it is now possible to proceed to estimate an error correction model, to reconcile the short-run behavior of the variables in the specified model with their long-run behavior. The critical ADF test statistic at levels for the residual is (-2.957110 and -2.617434) Untrended and (-3.557759 and -3.212361) trended for (5% and 10% respectively).

Error Correction Presentation: This is the last stage in the cointegration process and involves estimating our previous equation however this time with our error correction factor as a dependent variable. This involves regressing the first difference of each variable in the cointegration equation onto lagged values of the first-differences of all of the variables plus the lagged value of the error-correction term.

The result obtained is presented below;

A close inspection of the table above indicates that the error correction model has a high coefficient of determination. This can be seen from R-squared of 79 percent and the adjusted R-squared of about 71 percent. The R-squared shows the percentage of variation in the dependent variable that was accounted for by variations in the explanatory variables. The fitness of every regression result is based on its R-squared.

The F-statistic value of 10.84832 shows that the overall model is statistically significant at 1% and 5% levels of significance. This is because it is greater than the critical value of 2.57 and 3.79 at 1% and 5% respectively. This means that all the explanatory variables simultaneously explain the variations in the real demand for money. Also, all our variables are statistically significant at 95% confidence interval with the exception of DSAP, RTD and RTD.

Furthermore, the DW statistic, which is a measure of auto correlation, shows that the error correction model is free from the problem of serial correlation due to its value (2.19). As a result of this, an error correction model estimated can be confidently relied upon for making inferences on role of financial innovation on the demand for money.

The EC, which is the error correcting term in the model, indicates the speed of adjustment from short run equilibrium to the long run equilibrium state. The greater the co-efficient of the parameter, the higher the speed of adjustment of the model from the short run to the long run. In the model, one would notice that the ECM (*EC* above) is statistically significant at 5%. This shows that there's a dynamic adjustment from short run to log run. The coefficient of the ECM is 0.60. This indicates that 60% of the errors in the short run are corrected in the long run.

As regards the behaviour of our explanatory variables with respect to the regressand, a positive relationship exists between the third lag of RGDP and M2 confirming economic theory (Keynes *et al*) as regards the relationship between income and the demand for cash balances. Secondly, interest rate also conforms our a priori expectation in that, the sign of its coefficient is negative implying an inverse relationship between the demand for cash balances and the rate of interest. The third variable in our model CPI also aligns with theory in that it has a positive sign.

The variable often used to capture financial innovation in most empirical literature is the 4-6 month commercial paper (being proxied by the treasury bill rate in our model) the co-efficient of it in our model is negative (-0.044140) which confirms what theory says. However, it is not statistically significant. It was not dropped as this affected our Akaike information criterion; raising its value. This could be traced to the poor development of the money market where the treasury bill rate rules. This thus leads to a conclusion that financial innovation has had an impact though not significant impact on the demand for money in Nigeria under the period of our scope. The innovations that have occurred given the massive financial sector reforms that characterized the SAP era have had an impact on the demand for money though this is not significant hence, our result tallies with that of Busari [5]. Worthy of note is that though at present an appreciable level of innovation seems to be taking place at present, it is post consolidation which is outside the scope of this research project.

H_0 : SAP era financial sector liberalization policies have had no impact on the Demand for money.

H_1 : SAP era financial sector liberalization policies have had an impact on the Demand for money.

In order to investigate whether the financial sector liberalization during SAP in the Nigerian economy has affected the real demand for money, a dummy variable was included in the error correction model. The dummy variable was not significant at the 5 percent level however its exclusion raised the value of our Akaike Information Criteria and affected the values of some of our regressors. In spite of this, its co-efficient took on a negative sign. This means that Structural Adjustment Programme which saw to sweeping changes in financial sector has not led to some financial innovations which indirectly or directly affect the demand for money.

CONCLUSIONS AND RECOMMENDATIONS

This research project has looked at the demand for money and how it has been affected by financial innovations in the financial sector of Nigeria arising out of the Structural Adjustment Programme (SAP) of 1986.

The term financial innovation refers to anything which ensures greater access to information, quicker means of carrying out transactions and greater ease of liquidity with lower risk. It need not be a technological innovation as Solans [2] pointed out even the 'euro' is a financial innovation, It has both reduced transaction costs and eliminated exchange rate risks and has also acted as a catalyst for a number of improvements in various areas that have helped to create a more efficient financial system in the euro area as a whole.

However, its effect on the demand for money is what has aroused so much interest to it among economic scholars. Of particular interest has been its effect on the stability of the demand for money, in that if its impact on the demand for money is significantly large, then the effectiveness of monetary policy may be seriously threatened. In order to order to ascertain this impact, a model was specified and estimated using the co integration technique method. Data for the analysis was taken from 1970-2004.

Main Findings and Their Implications: After carrying out appropriate analysis using our model it was discovered that on the basis of individual tests of significance, all the slope coefficients were individually statistically significantly different from zero with the exception of DSAP, RTD and RTB which failed the test of significance at the 5% level. Hence our major findings are as follows;

- Lagged Interest on time deposits is negatively related to the demand for money.
- Lagged Treasury bill rate is negatively related to the demand for money.
- Real income is positively related to the demand for money.
- Price level is positively related to the demand for money.
- Structural Adjustment Programme has had no indirect effect on the demand for money via financial innovation.

In view of the above findings, the following are possible implications arising;

- The low interest elasticity of our demand for money is indicative of underdeveloped nature of the money market in Nigeria. The money market particularly the treasury bills are dominated by government (the Central Bank) with the end result being that the market lacks the depth and flexibility that it might have had with the presence of a diversified participant base. Hence in a model, expressing the demand for money as a function of Treasury bill rate, it is definitely going to be significant. This is also indicative of the ill developed nature of our financial system. Keynesian doctrine holds that for the smooth functioning of his liquidity preference theory the money market must be well developed.
- Income level is a primary determinant of demand for money by economic agents in Nigeria.
- The analysis also shows that the atmosphere is not conducive for the effective use of monetary policies, however as financial innovations have not affected the demand for money significantly; there is still a place for monetary policy as a macroeconomic stabilization measure.

RECOMMENDATIONS

In view of the above findings, this study has shown that financial sector liberalization which was one of the goals of SAP has not led to financial innovation which would have benefitted banking customers, deepened the money market and affected the effectiveness of monetary policy. It has also not had a significant impact on the demand for money. In the light of these findings, this research project suggests the following recommendations;

- A policy of attracting more participants (non-government) and private sector funds to the money market is necessary as this will deepen the market and make the market more dynamic and amenable to monetary policy. This will further reduce the present long time lags associated with monetary policy in Nigeria.
- Although, from our results financial innovation have not affected the demand for money thus there is still a basis for monetary policy. It is something we cannot run away from and as such, the CBN should be prepared for when it comes. Moreso, in the light of the recent recapitalization in the Nigerian banking sector which have led to financial innovations, the monetary policy strategy of the CBN should be fine-tuned to ensure it is well suited to deal with the challenges posed by financial innovation. The bank needs to be anticipatory through proper monitoring of the financial landscape, by following developments closely and by trying to predict the consequences of financial innovations that, at first, may appear very marginal.

Financial innovations can help to increase the efficiency of the financial system, but at the same time they complicate the environment in which monetary policy operates by affecting the demand for money function making it unstable.

This research project has x-rayed at the relationship between the demand for money and financial innovation and examined the notion that financial innovations introduced during Structural Adjustment Programme of 1986 have affected the demand for money. We therefore conclude by accepting our null hypotheses, thus financial innovation has had no significant impact on the demand for money in Nigeria and SAP era financial liberalization policies have had no indirect impact on the demand for money as well.

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